**Lab: Estimating a Population**

**Introduction**

Scientists can determine the number of animals in a large population by using a sampling technique called mark-and-recapture. Animals are captured, marked and then released. Later, the scientists return to the sampling site to capture more of the animals; some of them be caught for the first time (unmarked) and some of them will be recaptured (marked). Scientists then calculate the total population of the sampled area based on the ratio of marked animals to unmarked animals.

Fisheries biologists working for a State Department of Wildlife or Game and Fish Department utilize an electrofishing technique to capture, mark and recapture various species of fish in lakes and streams. This is done to make adjustments to creel limits and stocking numbers. The wildlife biologist will capture a fish, and mark it by punching a hole in the tail using a hole puncher. The fish are released unharmed and, approximately one week later, they will return and repeat the electrofishing technique to capture and recapture fish.

In this simulation, a bag will represent a stream/river where a population study is being conducted. Lima beans will represent the “animals.” All the beans in the bag represent the total animal population being studied.

**Procedure**

1. You have returned to the sampling site after previously marking animals in the sample area. In your first survey, you captured and marked 30 “animals” and released them back into their habitat.
2. Now, you will re-sample the site by shaking the bag and, without looking, reach into the bag and remove **40** “animals.”
3. Record the number of marked “animals” (recaptured and marked) and the number of unmarked beans (captured and unmarked) in data table as trial 1.
4. Return all the “animals” to their habitat.
5. Repeat the sampling technique in Steps 2-4 to complete a total of 5 trials. Record you data in the data table.
6. Calculate averages for each of the columns.
7. Using average values, calculate the original size of the bean population by using the following formula:

**M** = # initially marked **Estimated Pop. Size = M x (Cw/M + Cw/oM)**

**Cw/M** = average # caught during the trials with marks **Cw/M**

**Cw/oM** = average # caught during the trials without marks

1. Record the estimated population size in the data table.
2. VERIFY the actual population size by counting the total number of beans in the bag and record this value in the data table.
3. Finally, use the following formula to calculate the percent difference between the estimated and the actual population sizes. Record this difference in the data table.

**% Difference = Actual population # – estimated population #**

**Actual population #**

**Data Table 1.**

|  |  |  |  |
| --- | --- | --- | --- |
| **Trial** | **Total “animals” caught** | **# Caught with marks (Cw/M)** | **# Caught without marks (Cw/oM)** |
| **1** |  |  |  |
| **2** |  |  |  |
| **3** |  |  |  |
| **4** |  |  |  |
| **5** |  |  |  |
| **Averages** |  |  |  |

**Estimated Population Size \_\_\_\_\_\_\_\_\_\_\_\_\_\_ Actual Population Size \_\_\_\_\_\_\_\_\_\_\_\_\_\_**

**% Difference \_\_\_\_\_\_\_\_\_\_\_\_\_\_**

**Analysis of Data**

1. Assume you were actually performing this simulation to assess the number of Rainbow trout in the Popo Agie River in Sinks Canyon. What would you actually be doing at the river in Step 2?
2. Compare the estimated population size to the actual population size. Explain why they may not agree exactly.
3. What change in procedure might improve the accuracy of the estimated population?
4. Why would this sampling technique be used with animals instead of plants?